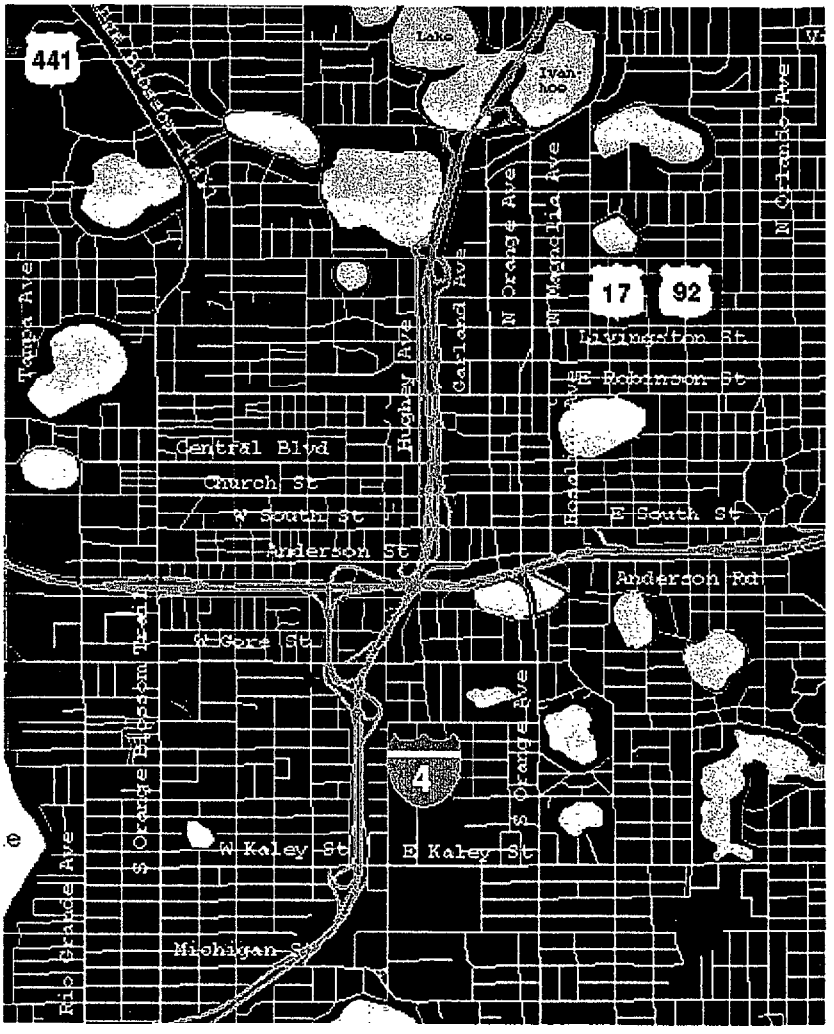
I-4 Surveillance and Motorist Information System

Free way Surveillance
Incident Detection
Traffic Management
Traveler Information
TravTek Interface



I-4 Surveillance/Motorist Information System

Orlando, Florida

Important Dates:

1991 - *I-4 SMIS Phase I Operational*

1992 - *TravTek Operational Test*

1995 - *I-4 SMIS Phase II Operational*

Background

The Orlando Metropolitan Area has a rich history in the development and deployment of intelligent Transportation Systems (ITS). Starting in 1990, the Florida Department of Transportation (FDOT) began development of a freeway surveillance system for I-4, the major interstate freeway serving this community. Called the I-4 Surveillance and Motorist Information System (I-4 SMIS), Phase I originally covered 11 miles in Downtown Orlando and was operational in 1991. This Phase I system played a key part in *TravTek* (short for Travel Technology), a major operational test used to demonstrate the collection and dissemination of real-time traveler information conducted throughout Orlando between 1992 and 1993.

Today, Phase II of the I-4 SMIS facility is complete and covers 39-miles along I-4 from Seminole County, through Orange County, the City of Orlando, and into Osceola County. The expanded system replaces or refurbishes Phase I equipment and software including the addition of color video surveillance (CCTV) cameras, fiber optic communications, a new detection system, hybrid LED/flip disk variable message signs, and the Management Information System for Transportation (MIST@), an advanced central control system software package developed by PB Farradyne Inc.

Owner:

Florida Department of Transportation District 5 (DeLand)

State Project No.: 99005-1416
(CEI) 99005-3416
FAP No.: NH-9999-(121)

PB Farradyne Inc.

PB Farradyne Inc. (PBFI), a wholly owned subsidiary of Parsons Brinckerhoff (PB), was retained as prime consultant by FDOT District 5 to provide an expanded surveillance and motorist information system for the I-4 highway corridor in Orlando. The responsibilities of PBFI included:

- Evaluating the existing system
- Designing the expanded system
- Preparing plans, specifications, and estimates (PS&E)
- Development of Central Control software (MIST@)
- Preparing operations and maintenance (O&M) manuals
- Operator training
- System operations

PBFI acted in a Systems Manager role, completing the design, software development, systems integration and operation and, in conjunction with PB Construction Services, the construction engineering and inspection.

Project Elements:

50 Color Cameras *(16-160mm zoom, 100% coverage of 39 miles)*

22 Variable Message Signs *(Hybrid LED / Flip Disk)*

69 Vehicle Detector Stations *(Type 170E Controllers with In-Pavement Loops reporting Volume, Occupancy, and Speed,*

5 Weather Stations *(report wet or dry conditions for use in Incident Detection)*

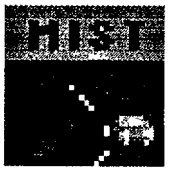
Fiber Optic Communications Backbone *(Separate Circuits for Video and T-1 Voice/Data Channels)*

Multiple Operator Interfaces *(Primary Control Center at FHP, Secondary Control at Remote Sites)*

MIST® Central Software *(Graphical User Interface with Data Collection, Control, and Incident Detection Features)*

Noteworthy Features

- The Management Information System for Transportation (MIST@) program, developed by PBFI, is being used for the central control and monitoring of field equipment. MIST is unique because it offers control capabilities exceeding those of any other available system. MIST@ is microcomputer based and uses a client-server architecture to provide both power and flexibility for ITS applications.
- A Speed Based Incident Detection Algorithm (SBIDA) is used by MIST@ and utilizes the history of speed data for each detection station (time of day, day of week, and weather) for monitoring conditions, User configurable parameters control the threshold and duration of speed changes needed to declare an incident.
- *TravTek* receives real-time congestion information via a dedicated interface with the I-4 SMIS. *TravTek* is a computer based data-fusion and traveler information system developed by PBFI as part of an Operational Test in 1992. This system is still used by several agencies for disseminating information on travel conditions and incidents.
- The Ramp Handler Algorithm monitors traffic conditions on two exit ramps that serve a major attraction. If either ramp becomes congested, changeable message signs on the mainline direct exiting traffic to the other ramp. This system operates much like a “reverse” or exit ramp meter.
- Fiber Optic Communications System Backbone with a redundant T-l data circuit and dedicated video circuits. This is the first such application for a Florida ITS project.
- The I-4 SMIS is providing a backbone communications system and, with the MIST@ operating system, an operational platform for integrating traffic management around the Orlando region. Remote Operator Workstations are already in place in FDOT District Headquarters in DeLand, Seminole County, and the City of Orlando, with a connection to Orange County planned for the near future.
- An industry standard, commercial-off-the-shelf SQL Database is used as the central database server for the MIST@ system. The SQL database provides both standardized reports and the flexibility to customize reports for both traffic engineering and transportation planning purposes.



The following MIST@ Control Modules are installed on the *I-4* SMIS:

MIST@ Operator interface

Variable Message Sign Control

Camera Control

Video Switch Control

Incident Management & Response

Detector Station Control

Traffic Flow Charts & Reports

Automated Pager Control

MIST63 Control System

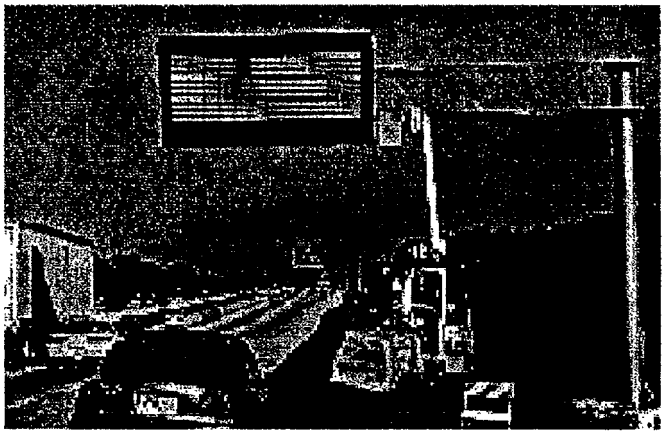
The I-4 SMIS is a unique configuration of the Management Information System for Transportation (MIST@) custom designed by PB Farradyne Inc. (PBFI) for the Florida Department of Transportation. The software is a digital, information management and control system that uses PC technology to monitor and control variable message signs, camera controllers, a video switch, and weather and speed detectors,

- MIST@ 01. Controls administrative features, login/logout and program operational parameters. Controls display of system map and other graphics, Allows standard or user customized reports and SQL database queries.
- VMS Control, Command VMS display from manual input or from pm-stored message database. Edit VMS display settings such as LED brightness, bad dot control, and temperature limits.
- Camera Control. Direct control of pan, tilt and zoom, both locally and remotely, via MIST@ OI. Ability to set and recall preset camera positions,
- Video Switch Control. Direct control of video matrix switching unit. Control of switch, either locally or remotely, via MIST@ OI. Switch control integrated into Incident Management module.
- Incident Management. Speed-Based Incident Detection Algorithm. Incident management via pre-stored, dynamic list of available resources for incident response. Manual incident inputs available for management of scheduled maintenance or construction activities.
- Detector Station Control. Polling of Type 170E controllers (with loop detectors) for data reporting once per 30 seconds, Command controller to synchronize and/or reset detectors,
- Traffic Flows. Display real-time charts and reports of data being reported by field detectors, Compare current versus historical data.
- Pager Control. Manage database of alpha-numeric pager numbers. Automated paging in the case of an incident and/or device failure.
- Event Scheduler. Allows the building and scheduled execution of commands.
- Ramp Handler Control. Special monitoring of exit-ramp conditions and semi-automated control of ramp VMS to manage exiting traffic.
- TravTek Interface. Reporting of congestion information by link to the *TravTek* computers and database.

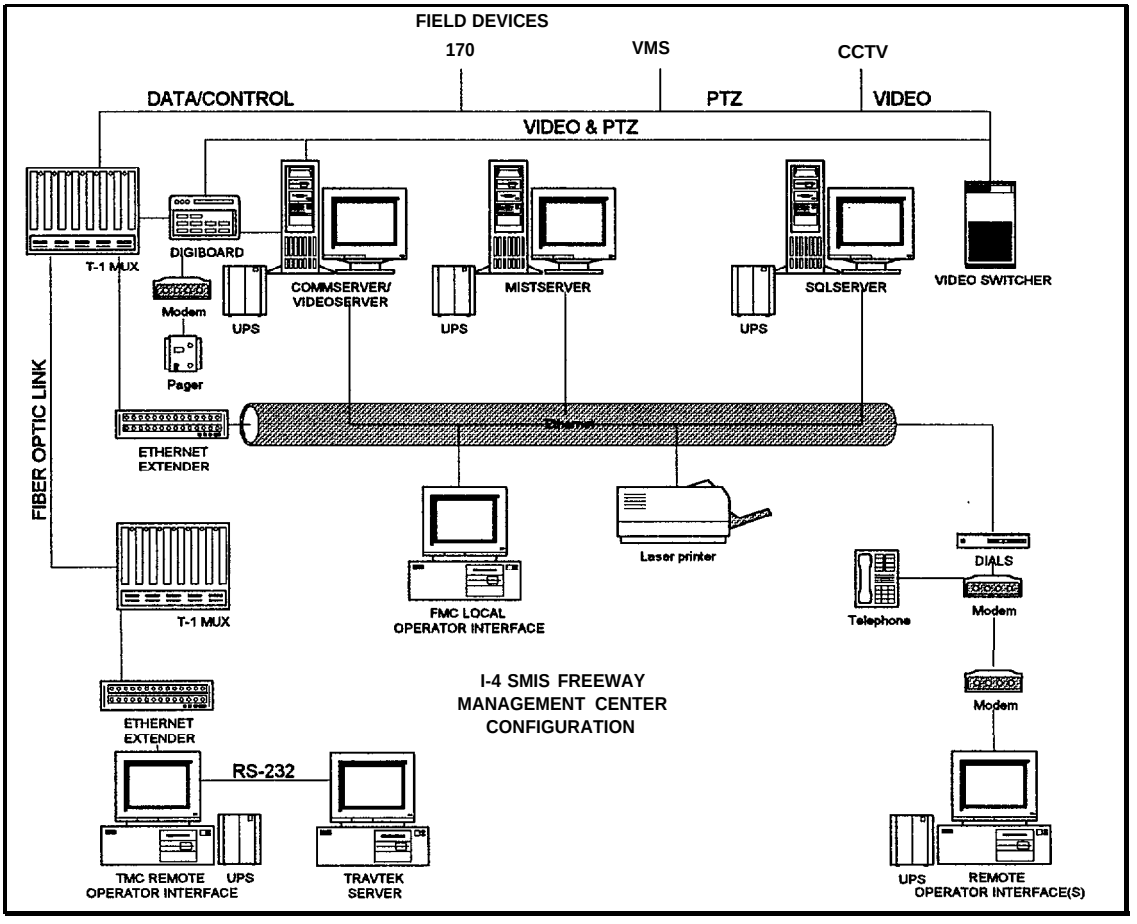
Hardware/Software Configurations

The PC-based computer system selected for the central control system has been developed around commercial off-the-shelf (COTS) software and industry standard network operating systems and SQL database servers. The Central Control system consists of the following elements:

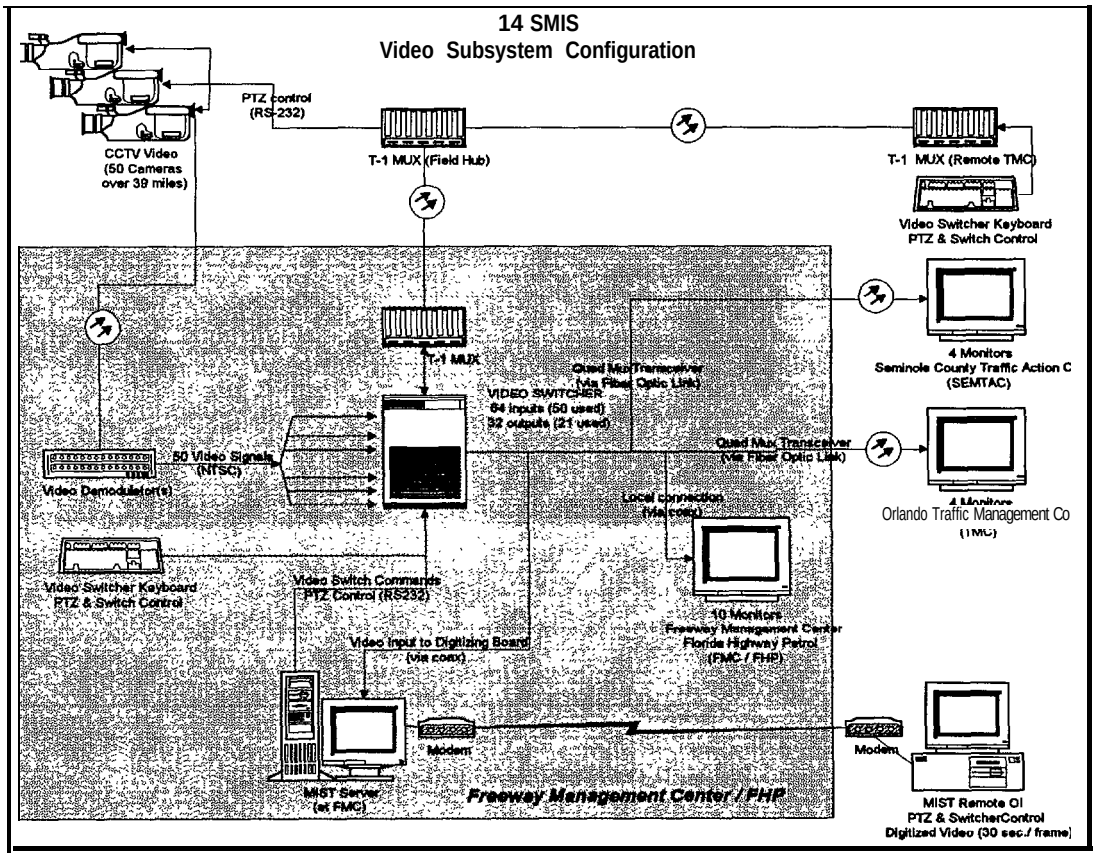
- Client / Server Architecture
- IBM OS/2 and LANServer Network Operating System
- Sybase@ SQL Relational Database Server
- Multiple Pentium-based PC Servers
- Network / SQL Database Server
- MIST@ Server
- Communications / Video Server
- Pentium-based Operator Interfaces (clients)
- Remote Access via Ethernet Bridges and Dial-Up Modems



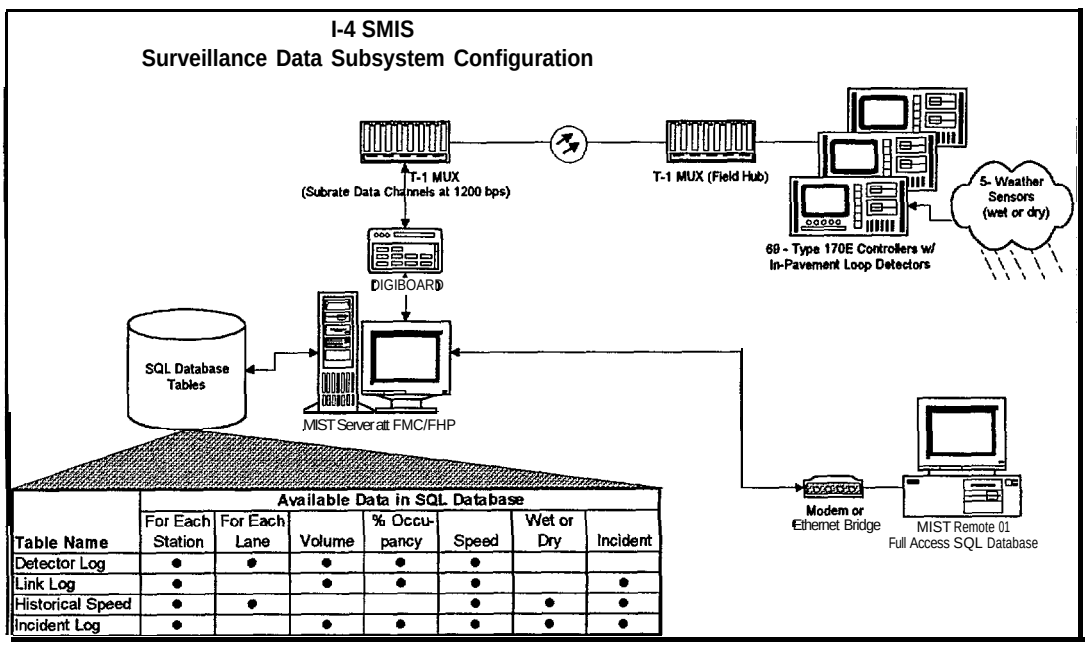
I-4 VMSs are a Hybrid LED / Flip Disk Technology within Walk-In Cabinets



The Client Sewer Architecture of the MIST@ Control System Uses Industry Standard Network Operating and Database Systems

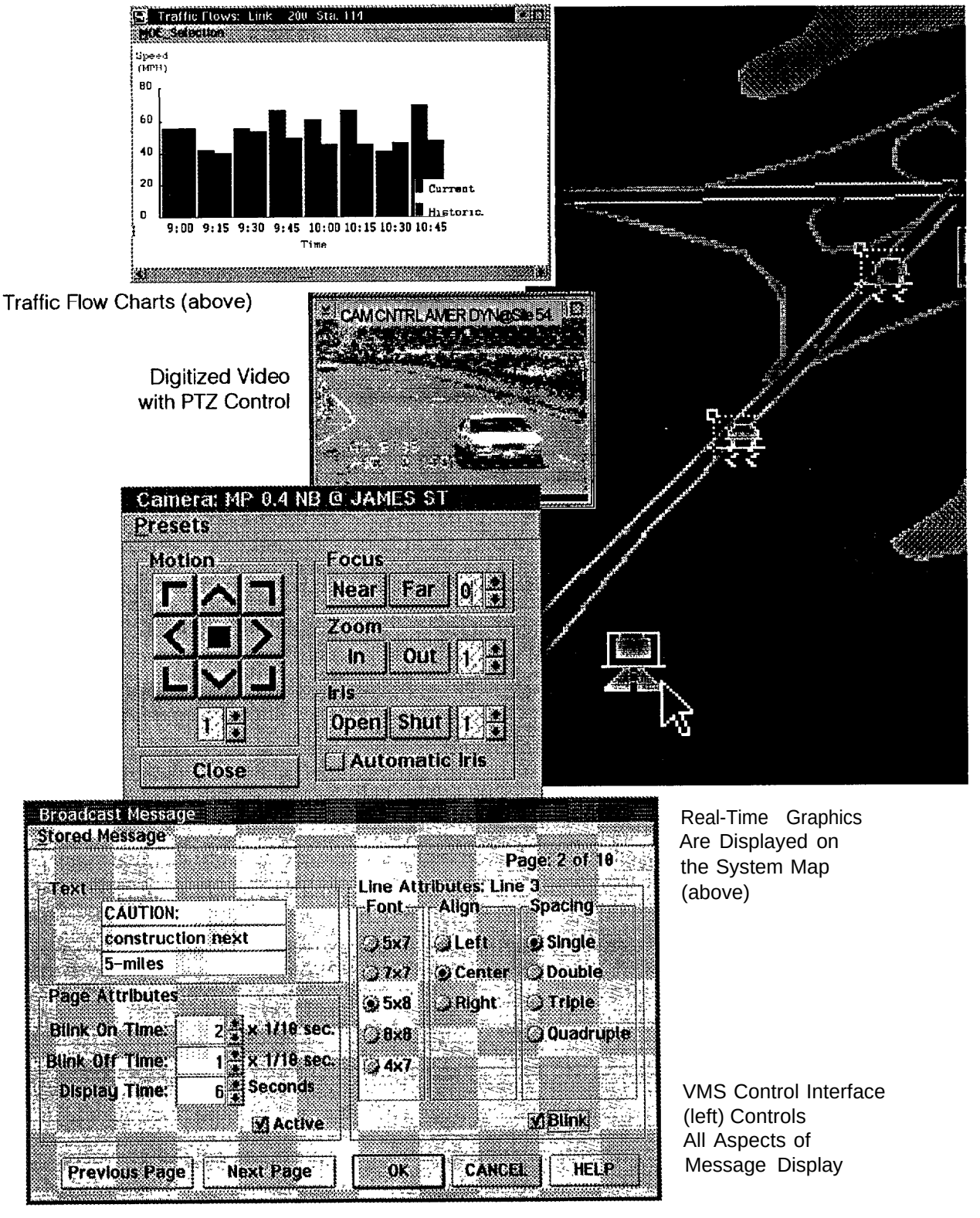


The Video Subsystem Provides Surveillance Capabilities to Local and Remote Agencies



	Available Data in SQL Database						
Table Name	For Each Station	For Each Lane	Volume	% Occu-pancy	Speed	Wet or Dry	Incident
Detector Log	●	●	●	●	●		
Link Log	●		●	●	●		●
Historical Speed	●	●			●	●	●
Incident Log	●		●	●	●	●	●

The Data Subsystem Provides Traffic Data for Surveillance Plus a Database for Traffic Engineering and Planning Uses



Traffic Flow Charts (above)

Digitized Video with PTZ Control

Real-Time Graphics Are Displayed on the System Map (above)

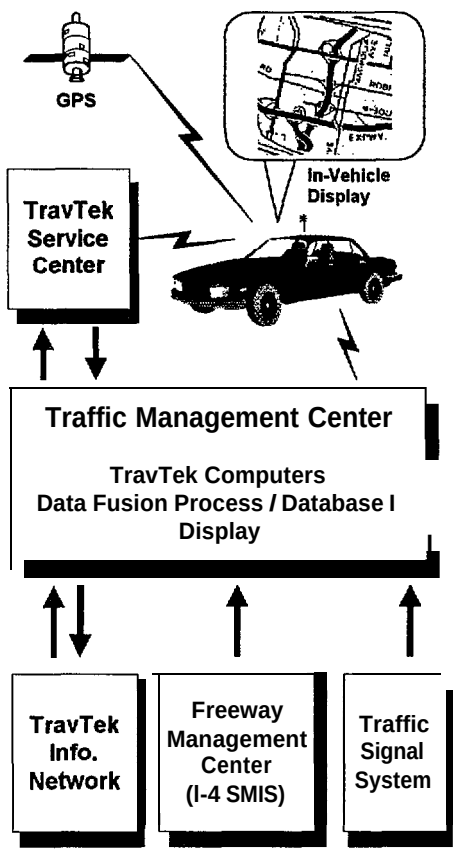
VMS Control Interface (left) Controls All Aspects of Message Display

The Screen Display for MIST@ Integrates All System Monitoring and Control Functions

A Public - Private *Pattnership*

Partners:

- *General Motors (PB Farradyne subcontractor)*
- *FHWA*
- *AAA*
- *FDOT*
- *City of Orlando*



TravTek & I-4 SMIS

The TravTek (travel technology) project was an Operational Test of a prototype, in-vehicle information system to provide motorists with up-to-date traffic information, and directions to destinations. In addition, the TravTek system offered useful information about Orlando-area attractions and services. PB Farradyne was a member of the *TravTek Partnership (see* at left) and developed the central software system including the database and data fusion algorithms,

A key element in the *TravTek* Project was the information provided by the I-4 SMIS. Originally, this was provided by the Phase I system. The I-4 SMIS Phase II system has also been integrated with the *TravTek* computers and now the MIST@ I-4 SMIS system sends real-time speed data to the *TravTek* database.

How TravTek Works

TravTek equipment was installed in 100 Oldsmobile Toronado (GM) cars with 75 made available through a rental agency and 25 used by local drivers. Drivers received continuous reports about congested routes to avoid. As new information became available on traffic incidents (accidents, disabled vehicles, construction and maintenance activities, etc.), drivers were offered alternate routes that reflected the shortest travel times on the highway network.

The in-vehicle *TravTek* device consisted of a video screen, a microcomputer, a GPS (geographic positioning system) receiver, and a radio for data communications, The dash-mounted video monitor could display maps with graphical representations of congestion or incidents, route guidance instructions, and information on services in the Orlando area.

Current Status

The *TravTek* computer system has been functional since the operational test began in 1992. However, there are no more active *TravTek* vehicles. The City of Orlando uses the *TravTek* system to monitor traffic conditions reported by its Signal Control System, the Police Department, and by the I-4 SMIS on the freeway.

The *TravTek* system is still considered a valuable tool for monitoring traffic conditions around Orlando. The City of Orlando is considering incorporating an enhanced version of *TravTek* in future upgrades of its traffic management systems,

I-4 System Benefits

- *50% Shorter Response Time to Incidents*
- *Driver Delay Reduced 20%*
- *Coordinated Traffic Management During Road Closures*
- *Reduced Traffic Data Collection Costs*

Engineering Costs

$1.2 million (includes engineering analysis, design, software, construction engineering and inspection (CEI) and system operation and training)

Construction Costs

$5.5 million (does not include approximately $2.0 million in infrastructure installed in Phase I and re-used for Phase II)

Team Acknowledgments

PBFI was assisted in the development of this project by several subconsultants. The following lists each firm and their role in the project:

- PBQ&D - Structural Design of VMS Supports.
- PB Construction Services - Construction, Engineering, and Inspection services.
- Geotechnical & Environmental Consultants, Inc. - Geotechnical Survey and Design Services.
- Transportation Engineering, Inc. - Survey and Data Collection Services.
- North American Controls Corporation - Communication Design support.

Contacts

PB Farradyne Inc.
901 N. Lake Destiny Drive, Suite 185
Maitland, Florida 32751

- Cary Vick, P.E., Project Manager
  (407) 875-3337; Email: vick@pbworld.com

PB Farradyne Inc.
3200 Tower Oaks Boulevard
Rockville. MD 20852

- Roy Sumner, Principal-In-Charge
  (301) 816-1854

Florida Department of Transportation
District 5
719 S. Woodland Blvd.
DeLand, FL 32720

- Fred Ferrell, P.E., District Traffic Operations Engineer (904) 943-5309

- Jon Cheney, P.E., I-4 SMIS Project Manager
  (904) 943-5322

Design
Software Development,
System Integration,
Construction Management,
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